

## ELECTRONIC DEVICE AND A METHOD IN AN ELECTRONIC DEVICE

### CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** This is a continuation of, claims priority to and the benefit of U.S. application Ser. No. 09/716,880 filed on Nov. 20, 2000, now allowed, which claims priority to and the benefit of Finnish Application Serial No. 19992510, filed Nov. 24, 1999, the disclosures of which are incorporated herein by reference in their entirety.

### FIELD

**[0002]** The disclosed embodiments relate to an electronic device and keyboard for electronic devices.

### BACKGROUND

**[0003]** In order to improve mobile communications available for people, various mobile communication equipment, such as cordless phones and mobile stations, have been provided in the prior art. A very popular piece of mobile communication equipment is the mobile station, which can be, for instance, a digital mobile station operating in a mobile communication system based on a cellular network according to the GSM standard (Global System for Mobile Communications).

**[0004]** Various devices for saving information, such as notebook computers, small hand-held computers or PDA (Personal Digital Assistant) devices are also known in the prior art. These devices can be used to save information given by the user, such as calendar data, notes, addresses and telephone numbers. Input of information in these devices usually takes place by means of a keyboard, but it is also possible to save textual information in some devices by writing it directly to a touch sensitive display by textual information in some devices by writing it directly to a touch sensitive display by means of a stylus, for example. The performance of these devices is continuously increasing, and they already include many properties known from PC devices (Personal Computers). Extension cards according to the PCMCIA (Personal Computer Memory Card International Association) standard are available for some devices for coupling these devices to mobile stations, for example. Then it is possible to use PDA devices, for example, by means of radio waves, to send and receive telefax messages, short messages (SMS, Short Message Service) and other text files wirelessly. In this explanation, a PDA device means a device according to the above description.

**[0005]** There are also known devices in which the operations of a mobile communication device and a PDA device have been combined. One such known device is the Nokia Communicator 9110, by which it is possible to connect to the Internet, use radiotelephone functions, such as receiving a call and selecting a number, and receive telefax messages, for example. The properties of mobile communication devices, such as mobile stations, are continuously increasing and usually include operations for saving the telephone numbers of persons and companies, for example. In this specification, the term mobile station means a mobile station which includes operations of the above described PDA device or a corresponding device.

**[0006]** In the present mobile stations as those described above and other electronic devices with a keyboard, the major

problem in implementation is the large number of connection lines especially when the keyboard includes a large number of keys, such as the numerical keys and the alphabetical keys. The Nokia 9110 Communicator device, for instance, has both a numerical keyboard and an alphabetical keyboard essentially like the one in computers, but smaller. The operation of a keyboard is relatively simple, but because of the large number of connection lines, the application specific integrated circuit, ASIC, becomes rather large, and the increase in the price of the circuit also increases the price of the complete device.

**[0007]** Each connection line requires the implementation of a connection element on the application specific integrated circuit. This connection element uses a lot more of the surface area of the semiconductor chip used for the implementation of the application specific integrated circuit than, for example, the implementation of other logic operations. Thus the number of connection lines increases the surface area of the semiconductor chip and, on the other hand, remarkably limits the number of functions that can be implemented on the ASIC. The number of connection lines of the ASICs used in mobile stations has not changed much between different generations. At the same time, the manufacturing technology of the application specific integrated circuits has developed from the line width of 0.55  $\mu\text{m}$  to the line width of 0.18  $\mu\text{m}$ , and the packing density of the logic has become 16 times higher. Because similar development will probably continue, the connection lines will form a more considerable limitation for the implementation of application specific integrated circuits.

**[0008]** Each keyboard connection line coupled to an application specific integrated circuit must be protected against an electrical static discharge (ESD). A keyboard is very sensitive to problems caused by an electrical static discharge. Because of this, there have been problems with electrostatic protection of the keyboard in the design of mobile stations including PDA properties. With the present application specific integrated circuits, which have a line width of 0.25-0.35  $\mu\text{m}$ , it is not possible to implement sufficient electrostatic protection in the application specific integrated circuit internally, but the protection must be realized with components external to the application specific integrated circuit. This again results in the situation that the components that protect from an electrostatic discharge increase the surface area and price of the circuit board. The situation will become even more difficult in the future when the manufacturing technologies of application specific integrated circuits develop towards even more narrow line widths.

**[0009]** In mobile stations in which the keyboard is implemented in a sliding or turning element of the mobile station, the problem is the realization of the interface between the mobile station and the keyboard, because a prior art keyboard of a mobile communication device implemented with a circuit board requires more than ten separate signals. The more signals have to be taken over this interface, the more complicated, more expensive and more vulnerable to errors the implementation becomes. In addition, the keyboards implemented by means of a circuit board according to the above have the problem that they are relatively thick.

**[0010]** A known electronic device like the one described above, in which an attempt has been made to solve the above described problems, has been presented in the U.S. Pat. No. 5,584,054. An electronic device comprises a touch sensitive display disposed in the body housing element, whereby the